

CLAIMS

1. A balun, comprising seven adjacently disposed coupled lines (30-36), an unbalanced port (Port 1) and first and second balanced ports (Ports 2 and 3), wherein second, third and fourth of the seven lines (32, 31, 30) lie adjacent each other in sequence on one side of a first of the seven lines (33), with the second line adjacent the first, and fifth, sixth and seventh of the seven lines (34, 35, 36) lie adjacent each other in sequence on the other side of the first line (33), with the fifth line (34) adjacent the first, the lines having corresponding first ends and corresponding second ends, the first end of the first line (33) serving as the unbalanced port (Port 1) and the second end of the first line (33) being connected to a ground reference, the first ends of the first, third, fourth, sixth and seventh lines (33, 31, 30, 35, 36) being connected to each other by conductive interconnect means (37), the second ends of the third and sixth lines (31, 35) being connected to a ground reference, the first ends of the second and fifth lines (32, 34) being connected to a ground reference, the second ends of the second and fourth lines (32, 30) serving as the first balanced port and the second ends of the fifth and seventh lines (34, 36) serving as the second balanced port.
2. Balun according to Claim 1, wherein the coupled length of each of the lines is approximately equal to one-quarter of the average operating wavelength of the balun.
3. Balun according to Claim 1, wherein one or more of the interconnect means is an

airbridge.

4. Balun according to Claim 1, wherein one or more of the interconnect means is a bypass.
5. Single-sideband mixer arrangement comprising a balun according to Claim 1.
6. Mixer arrangement according to Claim 5, wherein the unbalanced port (Port 1) is connected to a local-oscillator source (LO); the first and second balanced ports (Ports 1 and 2) are connected to respective first and second diode-mixer arrangements (41, 42; 43, 44); an output (45) of the first diode-mixer arrangement is connected to a first RF input port (51) and to a first input of a  $90^\circ$  hybrid and an output (46) of the second diode-mixer arrangement is connected to a second RF input port (52) and to a second input of the  $90^\circ$  hybrid, first and second outputs of the  $90^\circ$  hybrid constituting the upper-sideband and lower-sideband outputs, respectively, of the mixer arrangement.
7. Mixer arrangement according to Claim 6, wherein each of the diode-mixer arrangements comprises a pair of diodes connected in series across the relevant balanced port, the diode-mixer output being constituted by the junction between the two diodes.
8. Mixer arrangement as claimed in Claim 6, wherein the connections between the

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diode-mixer arrangements and the RF ports are by way of respective low-pass filters (47, 48).

9. Mixer arrangement according to Claim 6, wherein the connections between the diode-mixer arrangements and the 90°-hybrid inputs are by way of respective high-pass filters (49, 50).
10. Mixer arrangement according to Claim 6, wherein the 90° hybrid is a Lange coupler (53).
11. Downconverter arrangement, comprising a balun according to Claim 1.
12. Downconverter arrangement according to Claim 11, wherein the unbalanced port is connected to a local-oscillator source (LO); the first and second balanced ports are connected to respective first and second diode-mixer arrangements (41, 42; 43, 44); an output (45) of the first diode-mixer arrangement is connected to a first IF output port (51) and to a first output of a first 90° hybrid (53) and an output (46) of the second diode-mixer arrangement is connected to a second IF output port (52) and to a second output of the first 90° hybrid (53); a first input (54) of the first 90° hybrid constitutes the RF input port of the downconverter and a second input of the first 90° hybrid is terminated by a load (72), the first and second IF output ports (51, 52) being connected to first and second inputs, respectively, of a second 90° hybrid (71), a first output of the second 90° hybrid

constituting the IF output port of the downconverter and a second output of the second  $90^\circ$  hybrid being terminated by a load (73).

13. Downconverter arrangement according to Claim 12, wherein each of the diode-mixer arrangements comprises a pair of diodes (41, 42; 43, 44) connected in series across the relevant balanced port, the diode-mixer output being constituted by the junction (45, 46) between the two diodes.
14. Downconverter arrangement according to Claim 12, wherein the connections between the diode-mixer arrangements and the IF ports are by way of respective low-pass filters (47, 48).
15. Downconverter arrangement according to Claim 12, wherein the connections between the diode-mixer arrangements and the outputs of the first  $90^\circ$  hybrid (53) are by way of respective high-pass filters (49, 50).
16. Downconverter arrangement according to Claim 12, wherein the first and/or second  $90^\circ$  hybrid (53, 71) is a Lange coupler.